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THE EFFECTS OF MAGNETIC STORM PHASES ON
F-LAYER IRREGULARITIES
FROM AURORAL TO EQUATORIAL LATITUDES

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COLLABORATIVE STUDIES

We have started the collaboration with Dr. Leonard Kersley of the University College of Aberystwyth and his group. Several periods of interest in the low sunspot years of 1985 and 1986 have been identified when data were available from Kiruna, Sweden and from Goose Bay, Labrador as well as from equatorial sites. We have developed a contouring program to handle the Transit data and in fact have received data from several sample periods of very low magnetic activity over a period of several days. We have just begun this study of determining the pattern of F-layer irregularities during years of low solar flux. The evaluation of data sets has included new analysis (for Manila, for example) as well as evaluating older data, much of it at this date unused for scientific purposes.

While F-region irregularities are frequently spoken of occurring in the auroral region, the behavior of the irregularities as a function of sunspot number is significantly different from the behavior of the auroral region. Auroral data, primarily of the E layer green line, show no significant changes as a function of sunspot number in the latitude of the occurrence of this phenomenon; F-region irregularities show a great movement towards the polar region with low sunspot number. In order to predict the occurrence and level of the effects on trans-ionospheric propagation, the relationship to sunspot number must be ascertained. We feel the comparison of high latitude data from Sweden and Canada will allow us to state that the polar movement of the region during low sunspot years is a global phenomenon.

MODEL EVALUATION

Determining the morphology of equatorial F-layer irregularities as a function of longitude is vital for understanding the physics of the development of these irregularities. We are evaluating the observational basis which then can be used to test theoretical models. Satellite in-situ data, scintillation and spread F observations have been reviewed. The limitation of each data set is being set forth. The questions to be answered as to the physics of the longitudinal aspects of the morphology are (1) why do the months bordering the equinox have high levels of occurrence over all longitudes (2) why are there relatively high levels of occurrence in the Central Pacific Sector in the July-August period and in the 0-75° West sector in the November-December period (3) why are there very low levels of occurrence in November and December in the Central Pacific Sector and in July and August in the 0-75° West Sector. A cartoon as to the occurrence pattern, as we see it, as a function of longitude, is in early stages of development.

The paper on the morphology of equatorial irregularities relative to their generation has been prepared for the AGARD Symposium on Radio Location Techniques to be held in London, UK 1-5 June 1992; it has been sent in for clearance. Since the Global Positioning System as well as HF Direction Finding is affected by transmission thru the equatorial ionosphere, a paper on the morphology of equatorial irregularities appeared to be in order.

A paper entitled Onset Conditions for Equatorial Spread-F has been developed by Michael Mendillo, Jeffrey Baumgardner, Xiaoqing Pi, Peter J. Sultan of the Center for Space Physics and by Roland Tsunoda of SRI International. The paper has been submitted to the Journal of Geophysical Research.

Work is continuing addressing the possibility that high meridional neutral winds destabilize the normal tendency of the equatorial ionosphere to produce irregularities in the post sunset period. Models are being used to determine the longitudinal aspects of the neutral wind velocities. Previous work in this area (as noted in our last quarterly report) emphasized day-to-day variability; the present work emphasizes seasonal aspects as a function of longitude.

PRESENTATION

During this period of time Dr. Aarons gave a seminar at Boston University on the Morphology of F Layer Irregularities where he outlined his criticism of two papers which purport to explain the longitudinal pattern of equatorial F-layer irregularities.



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